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Perceive efficacy of Alteration in outsources Parts Repair System upon Performance: Case Study at powerplant maintenance center

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Abstract

This paper aimed to assess the impact of change on outsources repair parts system upon PPM in terms of operation excellence, customer intimacy, and decision making. Data required has been gathered from two sources. The first one is a questionnaire answers from the selected research sample. The other one is the quantitative data collected from information system and production planning record. SPSS program used to examine the collected information. This study revealed that the modification on outsources parts repair system has a positive effect on PPM in all study aspect: performance excellence, customer intimacy and decision-making. Moreover, the study exposed the improvement in parts turnaround time. Besides, an increase of parts repair quality has been noticed.

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Keywords: outsource parts repaire system; supply chain; operation excellence; customer intimacy; decision-making.

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1. Introduction and Background information

PPM powerplant maintenance "is a Jet Propulsion Center contains numbers of specialty shops such as NDT, Composite repair, plating, plasma spray, paint, welding, state of the art machine shop, sheet metal, thrust reverser shop, bearing, metrology and fluid analysis lab and harness shop. PPM is supported by a twin bay engine test cell and three APU test cells"[1].

Previously PPM was facing a difficulty keeping its production on track as planned to satisfy engines market demand. PPM management took the challenge mentioned by Hammer [2] "the major challenge for managers is to obliterate non-value adding work, rather than using technology for automating it". After studying the problem and reviewing the available solutions, PPM management perform its business solution based on BPR (business process reengineering), which covers the envisioning of new business strategies, the actual procedure design activities, and the accomplishment of the modification in its multipart: technological, human, and organizational dimensions [3].

PPM department signed a partnership agreement with Chromalloy; which is a "global technology company, partner with original equipment manufacturers, commercial airlines, the military and power companies to deliver innovative solutions that reduce manufacturing and operating expenses, and extend the life of gas turbine engines" [4]. This partnership agreement shaped a new process (supply chain) handling parts for repair. Moreover, this solution allows PPM as a customer to integrate Chromalloy information system to be acquainted with the status of each single part under repair at Chromalloy shops. Since the target of this research is to address the usefulness of the change occurred at outsource repair system. To achieve this target, information has been collected through two ways; first; answers of a targeted sample to a designed questionnaire. The respond percentage of distributed questionnaire was (.946). Second a quantitative operations process information system. Data has been analyzed using SPSS program. The questionnaire validity test reflected a high validity of (.955) as value of Alpha Cronbach's test. The study revealed that the majority of the sample responses agree that the new outsources repair system achieved an operations excellence, customer intimacy and Decision-making. Second; data collected from operation system data base had been analyzed, the result shows remarkable decreas in turn around time for under repair parts and zero defected or lost items.

The PPM management executed a business partnership with Chromalloy company to perform a new outsource parts repair system. Information and communication technologies, process and people were the crucial set of information systems (IS) used to conduct such a global business partnership. PPM estimated that information systems (IS) would provide solutions for the problems and challenges occurred, by mean of transferring raw data to useful information through three major steps: input, processing, and output. Moreover, (IS) represents a great combination of people, organization (process), and technology [5].

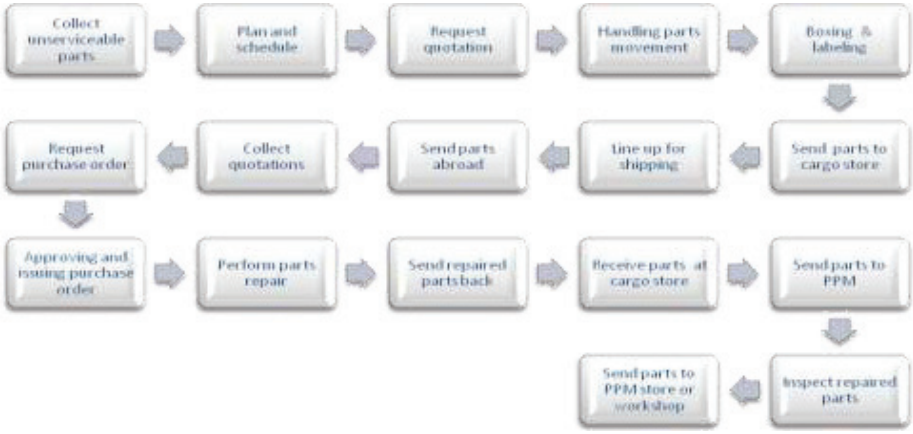
What is (IS)? Information systems are made up of five components: people, process, hardware, software, and data, the last three components are fitting under the category technology [6]. As per Kenneth& Jane Loudon: "Information systems are the foundation of fast-paced supply chains." [5] A supply chain is dynamic and involves the constant flow of information, product, and funds between different stages [7].

The new outsource parts repairer's system has a dramatically changed in three terms; first: installing and using advanced hardware, software and communication tools (suitable technology). Second: special team has been assigned to perform the required tasks. Third; modification of outsource parts repair process as follow:

a- Previous process steps illustrated in figure (a) contains:

1. Collect unserviceable parts by planner,
2. Plan and schedule repair by planner,
3. Request repair quotations by planner,
4. Handling parts by Logistic team,
5. Boxing and labeling by PPM store,
6. Send parts to the cargo store by logistic team,
7. Line up parts for shipping cargo store,
8. Send to our office abroad ,

9. Collect minimum of 3 quotations by our office
13. Send back repaired parts by our office



abroad,
10. Request purchase order by our office abroad,
11. Approve and issue purchase order by procurement section,
12. Perform parts repair by our client repair shop,
14. Receive parts at cargo store,
15. Send parts to PPM,
16. Inspect parts repair by PPM inspectors,
17. Send parts to workshop or PPM store by logistic

Fig. (a) Previous process flow chart of outsource parts repair

b- Modified process steps illustrated in figure (b) contains:
1. Collect unserviceable parts by planner,
2. Plan and schedule repair by planner,
3. Handling parts by Logistic team,
4. Boxing and labeling by PPM store,
5. Deliver parts to Chromalloy office at PPM.
6. receive parts at PPM from Chromalloy office,
7. Inspect parts repair by PPM inspectors,
8. Send parts to workshop or PPM store by logistic

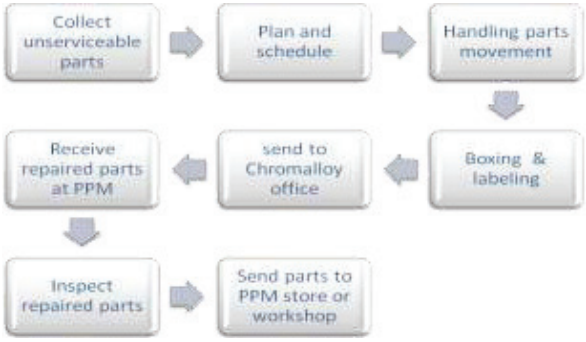


Fig. (b) Modified process flow chart of outsource parts repair

This study will assess the implementation of (IS) upon PPM performance in three facets: First one is operational excellence, which is executing tasks in an efficient and effective manner across the value chain with a focus on delivering value to customers [8]. The second one is customer intimacy, which is building relationships that are a win-win relationship for both parties [9]. And the third one is a decision making which is the act of choosing between two or more options of action [10].

Nomenclature

PPM	Power Plant Maintenance.
BPR	Business Process Reengineering.
MIS	management information system.

2. Related work:

Adapting Information systems is no more a choice for firms' management to perform business. It is mandatory in the era of globalization. Evaluating the effect of information system upon performance is widely considered by both practitioners and researchers. Herewith some latterly performed studies.

Prajogo, Daniel and Olhagerb Jan studied 232 Australian companies, under the subject: supply chain integration and performance: The effects of long-term relationships, information technology and sharing, and logistics integration. they examine the integrations of both information and material flows between supply chain partners and their consequences on operational performance, based on long-term supplier relationship as the driver of the integration. The study revealed that long-term supplier relationships have both direct and indirect significant effects on performance; the indirect effect via the effect on information integration and logistics integration. Information technology capabilities and information sharing both have significant effects on logistics integration. They found that logistics integration has a significant effect on operations performance. [11]

This current study differ from this previous one it in term of; the independent variable, where current study independent variables was taken holistically as information systems (people, technology and process). Moreover the dependent variables were not only performance, but it includes customer intimacy and decision making.

Under the title of ; The Impact of Management Information Systems Adoption in Managerial Decision Making: A Review, the researchers attempte to give a better and clearer understanding of technology adoption and information system success in administrative decision making through reviewing existing literature. This study proposed a theoretical model. That consists of six components: MIS quality, information quality, top management support, perceived usefulness, decision makers' satisfaction and quality of managerial decision making. [12]

Current study differ from this one in terms of dependable variable; where current study foucse on decision-making, customer intimacy and excellence performance. Beside the current study is an imperical study.

3. Problem statement

The objective of this research is to assess the impact of outsources repair parts system change upon PPM operations. This target could be formed in three questions:

- Does the change in outsources parts repair system has an impact on the PPM performance in term of Operation excellence?
- Does the change in outsources parts repair system has an impact on the PPM in term of Customer intimacy?
- Does the change in outsources parts repair system has an impact on the PPM performance in term of Decision-making.?

4. Methodology of solution:

To answer the research questions, the descriptive analytical approach has been adopted. Researcher collected the information from two sources, the first one is by a designed questionnaire contains items related to the three factors of the study. Questionnaire distributed to the targeted sample of the study in all departments effected. The second source is the quantitative data collected from the operation database.

The Questionnaire was distributed to the targeted sample being selected. As shown in table (1) in details. The Sample value was 94 employees which is 22.65% of the PPM staff with respond of 94.6%. The collected data have been entered into (SPSS) program, coded, and labeled. Descriptive statistics have been used to describe respondents' answers to questions.

Table 1. Research sample details

PPM Staff	Sample	Respond
415	94 (22.6%)	89 (94.6)

The process of the analysis and interpretation of the results will proceed as the following scenario; first, test the questionnaire validity and reliability in order to make sure that the questionnaire would measure what is intended to serve. Second, respondents responses concerning if the new system implemented achieve an operation excellence. Third, respondents responses concerning whether the new parts repair processes achieve customer intimacy. Fourth, respondents responses concerning if the implementation of the new system affect decision-making processes. Fifth the efficiency and effectiveness of the new system in terms of quality, quantity and turnaround time of parts sent for repair.

5. Numerical results:

The study concluded with the following results;

5.1. The questionnaire validity has been tested by using Cronbach's alpha statistic, which is widely used in the social sciences, business, and other disciplines. It named alpha by Lee Cronbach in 1951. Cronbach's alpha is generally used to assess the internal consistency or reliability [13]. Table. 2. showed that the value of Alpha Cronbach's is (0.955), which indicates that the questionnaire has a very high validity. This means the questionnaire items are highly correlated with the total degree of the questionnaire.

Table. 2. Reliability Statistics

Cronbach's Alpha	N of Items
.955	29

5.2. Testing the respondents' responses regarding if the new system implemented achieve an operation excellence. when testing the Respondents answers in percentages The total average mean of the respondents' responses is reaching (3.80) which indicates that the majority of the sample responses agree that the new system of outsources parts repair effect operations excellence in PPM.

To answer question number one Pearson's correlation coefficient is being done as in table 3. It is clearly seen that person's correlation coefficient is equal to (0.954) with significant level (0.01), which indicated that there is high positive correlation relationship between implementing the new supply chain and operation excellence. Therefore, the new outsource parts repair system has positive effects to improve the operations in PPM.

Table 3. Correlation relationship between implementation of new outsource parts repair system and operation excellence.

		implementation of new supply chain system	operation excellence
implementation of new supply chain system	Pearson Correlation	1	.954**
	Sig. (2-tailed)		.000
	N	36	36
operation excellence	Pearson Correlation	.954**	1
	Sig. (2-tailed)	.000	
	N	36	38

**. Correlation is significant at the 0.01 level (2-tailed).

5.3. Testing respondents responses concerning whether the new outsource parts repair system achieve customer intimacy. by testing the Respondents answers in percentages The high respondents' views are shown by the mean value to the sources of customer intimacy that ranged between (4.08 to 3.93).Therefore, this results answer the first question, which is the implementation of the new supply chain lead to change in customer intimacy.

Table.4. Correlation relationship between customer intimacy and execution of new supply chain

		implementation of new supply chain system	customer intimacy
implementation of new supply chain system	Pearson Correlation	1	.926**
	Sig. (2-tailed)		.000
	N	36	36
customer intimacy	Pearson Correlation	.926**	1
	Sig. (2-tailed)	.000	
	N	36	40

**. Correlation is significant at the 0.01 level (2-tailed).

To see if there is a positive or negative impact of execution of the new supply chain on customer intimacy correlation coefficient between the two variables the dependent (customer intimacy) and the independent variable (execution of the new supply chain) is done as in the table (4) it is obviously observed that person's correlation coefficient is equal to (0.926) with significant level (0.01), which indicated that there is high positive correlation relationship between implementation of the new system of parts repair and customer intimacy. Therefore, the implementation of the new supply chain participated positively to enhance customer intimacy, through many ways such as integrated information. This result answers the research second question.

5.4. Testing respondents responses concerning if the implementation of the new system affect decision-making processes. When testing the Respondents answers in percentages, the total mean value of respondents' views is reaching (3.96) with Std. (0.73); this indicates that the majority of the sample responses agree that the new parts repair system affect decision-making processes.

Table. 5. Correlation relationship between customer intimacy and execution of new supply chain

		implementation of new supply chain system	decision making
implementation of new supply chain system	Pearson Correlation	1	.866**
	Sig. (2-tailed)		.000
	N	36	36
decision making	Pearson Correlation	.866**	1
	Sig. (2-tailed)	.000	
	N	36	40

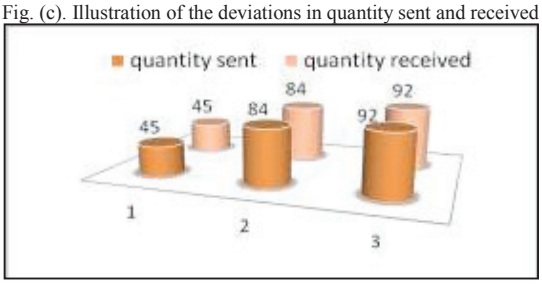
**. Correlation is significant at the 0.01 level (2-tailed).

From table 5 it is obviously seen that there is a correlation relationship between implementation of the outsource repair parts and decision making, this positive relationship was clearly approved as the correlation coefficient is equal to (0.866) with significant level (0.01).

5.5. For testing the efficiency and effectiveness of the new outsource parts repair system, data collected from production planning database [14] and analyzed. and findings

5.5.1. Figure (c) shows the comparison between quantity sent and quantity received. The average quantity of parts sent for repair is equal to the same average quantity of received ones. This indicate that there is no such things as damages to spare parts, or completely unable to do maintenance for them.

Fig. (c). Illustration of the deviations in quantity sent and received



5.5.2. Figure (d) shows the mean values in total turnaround time consumed. It is seen that the mean value of total time consumed during the four selected periods of implementing the new supply chain is reaching range between 34 to 92 days that reflects a significant improvement comparing to the previous system sequences, in which parts repair takes between 84 to 423 days. This improvement in turnaround time will add value to the PPM performance.

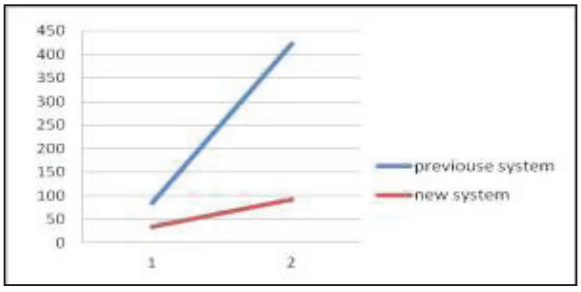


Fig. (d). Illustration of the deviations in total turnaround time

6. Conclusion and recommendations:

6.1. In this era of time the compotition between organizations mainly concentrate in the systems shapping the bussiness operations.therefor it is essencial for management to review their operations systems periodicly and pursues effectivness and max efficincy. This research evidence the crucial of system review and its usifllness to the organization, which shows in the following results.

6.2. The study revealed that the majority of the sample responses agree that the new outsource parts repair system achieve operations excellence for PPM. The operations Excellency observed more through the respondents' answers if the new outsource repair system;

- provide better supply chain processes,
- achieve better internal coordination,
- achieve better external coordination,
- reduce cost in terms of logistic
- reduce operation expenses

6.3. It is clearly seen that the majority of the sample responses agree that the new outsource parts repair system has a positive effect on customer intimacy. it was noticed that the most sources of change in customers' intimacy are reflected byrespondents opinions if the new outsource repair system:

- integrated information internally,
- integrated information with exterior partner,
- enhance customer satisfaction,
- efficient use of clients knowledge growth.

6.4. The study concluded that the majority of the sample responses agree that the new outsource parts repair system affect decision making processes.The effect of new system implementation on decision making processes is reflected through the following answers if the new outsource repair system;

- gathering data, and information,
- imitate full consideration of facts and status,
- meet the concerns and interest of partners.

6.5. The proved that there is a positive and significant correlation between implementation of the new outsource parts repair system and parts turnaround time. Besides, implementation of the new system gives zero defected parts.

6.7. from the researcher point of view, Table 6 gives a comparative summary of the status before and after implementing the new outsources parts repair system. It reflects the positive impact of the new system over the previouse one.

Table 6. Summarize the status before and after implementing the new system

factor	Previous system	New system
Ambiguity	Ambiguous turnaround Time, quantity and quality for parts	Confidence in turnaround time, quantity and quality for parts
Lost or damaged		Minimized to 0%
Cost		Minimized
Time	Between 48 and 423 days	Decreased between 34 and 92 days
Production	Repeatedly amendment	Very seldom to revise

scheduling		
Chang prices	Fluctuating prices	Fixed prices
Customer satisfaction	Respond with extra effort and cost	Respond to demands in perfect time
Decision making	Uncertainty effects decision making negatively	Clear vision and calculated steps
Technology	Using intranet and regular mail	Using advanced hardware, software and communication technology.
Inventory	Increase in unserviceable parts	decrease unserviceable parts

6.8. Based on the success of this bussiness solution, researcher recommend to start another local and regional business partnership to mitigate any potential risks of having one outsource. beside enhance PPM goals; obtaining parts repaired in lowest posible price, highst quality and shortest turn around time. in addition this recommendation gives PPM management more options and flexability doing the business.

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